Claims:

1. A data transmission apparatus for implementing multiple service flow in a multiple service ring including a trunk pipe and at least two nodes each with at least one flow, said apparatus comprising:

a flow Rx framer coupled to said flows for converting data received from said flows into data packets of a predetermined protocol;

transmission setup means for setting-up information indicating the destination node address and destination flow for packets of said predetermined protocol to be transmitted; and

a Tx framer for encapsulating said information indicating the destination node address and destination flow and the packets of said predetermined protocol into frames of the multiple service ring and transmitting the same along said trunk pipe to a downstream neighbour node along the ring.

2. The data transmission apparatus according to claim 1, wherein said predetermined protocol is a XP(processing protocol), and said apparatus further comprising:

a Rx framer for receiving and de-framing data frames of the multiple service ring from a upstream neighbor node along said trunk pipe to obtain at least a destination node address and XP packets; and

transiting means for transiting the frames destined to other nodes to said Tx framer so as to forward the frames destined to other nodes to a next node.

3. The data transmission apparatus according to claim 2, further comprising:

a destination flow determining means for determining a destination flow of the XP packets for a Universally or Locally administered address; and

a flow Tx framer for converting said XP packets for a node with a Universally or Locally administered address from the Rx framer into data of format of local flow and sending the local flow data to a corresponding flow determined by said destination flow determining means.

4. The data transmission apparatus according to claim 1, wherein said transiting means transits the frames destined to other nodes at a fast and almost fixed rate.

5. The data transmission apparatus according to claim 1, wherein said multiple service ring is a dual-ring structure consisting of a pair of unidirectional count-rotating ringlets, said multiple service flow is based on RPR, and said Rx framer is RPR Rx framer and said Tx framer is RPR Tx framer.

6. The data transmission apparatus according to any one of claims 1 to 3, wherein said destination flow determining means includes a discriminator for determining whether said received packets for a node with a Universally or Locally administered address are unicast, multicast or broadcast; a flow member copying means for making copies of the packets for each of the corresponding flow if multicast or broadcast is determined within a membership group in a node; and flow identifier determining means for determining destination flow from FT and FN fields in the received frames.

7. The data transmission apparatus according to claim 6, wherein said transmission setup means sets up destination node address(NA), and FT and FN fields for indicating the type and NO. of the destination flow.

8. The data transmission apparatus according to claim 7, further comprising a Tx schedule unit for scheduling the transmission of data frames according to a priority of the frames, and decide which frame will go first to the downstream along the ringlet.

9. The data transmission apparatus according to claim 8, further comprising a flow based protection (FBP) unit for performing flow based protection to provide at least one flow to be used as a standby in case of failure of the used flows.

10. The data transmission apparatus according to claim 9, wherein said FBP unit provides 1+1 FBP to designate a mate Standby Flow with the same service property, source and sink in which payloads of the mate Working Flow and Standby Flow carries the same traffic, and Once FBP occurred for this working flow, said standby will replace this working flow within 50ms.

11. The data transmission apparatus according to claim 9, wherein said FBP unit provides 1:1 FBP to designate a mate Standby Flow with the same service property, source and sink in which payloads of the Standby Flow can run the other additional traffic, and once FBP occurred for this Working Flow, the additional traffic will be dropped out within 50ms.

12. The data transmission apparatus according to claim 9, wherein said FBP unit provides 1:N FBP to designate a mate Standby Flow with the same service property, source and sink in which payloads of the Standby Flow runs the other additional traffic, and once FBP in one of N Working Flow occurred, this additional traffic will be dropped out within 50ms.

13. The data transmission apparatus according to any one of claims 9—12, wherein said FBP unit is for one of Ethernet and TCE.

14. The data transmission apparatus according to claim 13, wherein said MSF uses Fairness arithmetic and supports both local address and global node address, said local address is PLAS that is an address of node link on the MSF ring and has local meaning only along the MSF ring.

15. The data transmission apparatus according to claim 7, further comprising a frame sequence number generator for generating frame sequence number sequentially with respect to a specified modulus for each of the data frames to be transmitted at the transmitting side ; and

at the receiving side, a FSN extractor for extracting a FSN with respect to a peer-to-peer modulus from the received data frames; a counter at the receiving side for counting the number of the received data frames; and a comparator for comparing the counted frame number with the extracted FSN, if mismatch, an error reflecting transport performance is indicated.

16. The data transmission apparatus according to claim 15, wherein said destination flow determining means gets at lease one of PT, PFI, a value of FT/CS/NM, FN and FSN from the received frames from the upstream node, and said transmission setup means attaches PT, PFI, a value of FT/CS/NM, FN and FSN into the data frames to be transmitted.

17. The data transmission apparatus according to claim 16, wherein said RPR Rx framer, RPR Tx framer and the transiting means are of IEEE802.17 MAC layer; said flow Rx framer, said transmission setup means, and said destination flow determining means, said FSN generator, FSN extractor, counter, comparator, and flow Tx framer are of the XP layer.

18. The data transmission apparatus according to claim 17, further comprising a flow adaptation function unit having functions of the signal and rate transform, synchronous function between flow Rx/Tx framer and flow service interface, and said flow adaptation function unit is of a flow processing layer.

19. The data transmission apparatus according to claim 18, wherein said flow processing layer is a upper layer of said XP layer, said XP layer is a upper layer of said IEEE802.17 MAC layer, and corresponding interfaces are provided between the respective layers.

20. The data transmission apparatus according to claim 17, further comprising a shaper for generating a rate-limiting indication so as to reject excessive transmissions and avoid overflow, and said shaper is of XP layer.

21. The data transmission apparatus according to any one of claims 1—3, wherein said frame includes at least one of a RPR header field, Extended protocol field, PT field, PFI field, Reserved fields, FT/CS/NM field, FN field, FSN field, HEC field, payload of XP, and XP payload FCS.

22. The data transmission apparatus according to any one of claims 1—3, wherein a network of said MSF is divided into a XP layer network that provides the transport of adapted information through a XP trail between XP access points and a MDL layer network that provides the transport of adapted information through a MDL trail between access points.

23. The data transmission apparatus according to claim 22, further comprising a co-located XP trail termination source and sink pair, said XP trail termination source accepts adapted information at its input, adds the flow traffic, inserts CS or NM packets and presents the characteristic information of the XP layer network at its output, and said XP trail termination sink accepts the characteristic information of the XP layer network at its input, terminates the flow traffic, extracts the CS or NM packets and presents the adapted information at its output, wherein said XP trail termination source and sink pair is of XP layer network.

24. The data transmission apparatus according to claim 22, further comprising a co-located MDL trail termination source and sink pair, said MDL trail termination source accepts adapted information at its input, inserts CS or NM packets and presents the characteristic information of the MDL layer network at its output, said MDL trail termination sink accepts the characteristic information of the MDL layer network at its input, removes the CS or NM packets and presents the adapted information at its output, wherein said MDL trail termination source and sink pair is of MDL layer network.

25. The data transmission apparatus according to claim 22, wherein said MSF network provides the information transfer capability required to support various types of services of different bit rates by various server layers, and offers a XP trail and uses the XP trail in a server layer network.

26. The data transmission apparatus according to claim 22, further comprising a co-located pair of XP/Client adaptation source and sink, said XP/Client adaptation source performs the function of Adding XP header between its input and its output, and said XP/Client adaptation sink performs the function of Remove XP header between its input and its output.

27. The data transmission apparatus according to claim 22, further comprising a co-located pair of MDL/XP adaptation source and sink, said MDL/XP adaptation source performs the functions of packet multiplexing and adding MDL header between its input and its output, and said MDL/XP adaptation sink performs the functions of packet de-multiplexing according to flow number value and MDL header extraction between its input and its output.

28. The data transmission apparatus according to claim 22, wherein said MSF network provides a point-to-multipoint MDL Network Connection/Flow that multicasts customer traffic from single node to a group of nodes; and a point-to-multipoint XP Network Connection that multicasts customer traffic within a single node, from an MDL/XP adaptation sink to multiple XP/Server adaptation sinks.

29. The data transmission apparatus according to any one of claims 1-3, wherein said flows include at least one of Ethernet, TDM Circuit Emulation including the emulation of G.707 SDH circuit -- Transport of TU-11, TU-12 or TU-2, G.702 PDH circuit -- Synchronous and asynchronous circuit transport, Video signal, Voiceband signal, Digital channel supported by 64 kbit/s-based ISDN, and an trunk pipe of other MSR span with a lower rate than that of this trunk pipe.

30. The data transmission apparatus according to any one of claims 1-3, further comprising: a flow based multicasting unit for duplicating data frames from a source flow getting a payload of the frame to other multiple flows with the same FT field value within a node.

31. The data transmission apparatus according to any one of claims 1-3, further comprising: a bandwidth limitation unit for providing bandwidth limitation to a specific flow.

32. The data transmission apparatus according to any one of claims 1-3, further comprising: a merging unit for merging plural flows of the same FT field value to form a flow merging group(FMG) similar to one logical link.

33. The data transmission apparatus according to any one of claims 1-3, further comprising: a line speed filtering unit for filtering and classifying frames based on certain protocol fields of upper layer in the payload of frame.

34. The data transmission apparatus according to any one of claims 1-3, further comprising: a flow mirroring unit for monitoring the incoming or outgoing traffic on a related flow by connecting a sniffer to a "mirrored to" flow.

35. A multiple service ring system comprising a plurality of nodes, each node including a data transmission apparatus according to any one of claims 1-34, wherein each of said nodes is assigned a node address(NA), and data incoming to a node contains a destination node address, and said destination node address is XOR'ed with the NA of a node with a Universally or Locally administered address to check for match or mismatch.

36. The system according to claim 35, wherein an external timing source is provided to one of the nodes along the ring, and the other nodes make reference to the timing signaling from said one node for synchronization.

37. The system according to claim 36, wherein said nodes are coupled in a double fibre ring or a single fibre ring.

38. The system according to claim 36, wherein one of the nodes is only coupled to another node with a flow.

39. The system according to claim 36, wherein one of the nodes forms broadcasting connection to other nodes with trunk pipes in a DVB application.

40. The system according to claim 36, wherein one of the nodes is only coupled to each of the other nodes with a flow to form a pseudo-mesh connection while other four nodes are connected to form a two-fibre ring.

41. A data transmission method for implementing multiple service flow in a multiple service ring including a trunk pipe and at least two nodes each with at least one flow, said method comprising:

a flow Rx framing step of receiving data from a flow and converting the received data into data packets of a predetermined protocol;

a transmission setup step of setting-up information indicating the destination node address and destination flow for packets of said predetermined protocol to be transmitted; and

a Tx framing step of encapsulating said information indicating the destination node address and destination flow and the packets of said predetermined protocol into frames of the multiple service ring and transmitting the same along said trunk pipe to a downstream neighbour node along the ring.

42. A data transmission method according to claim 41, wherein said predetermined protocol is a XP(processing protocol), and said method further comprising:

a Rx framing step of receiving and de-framing data frames of the multiple service ring from a upstream neighbor node along said trunk pipe to obtain at least a destination node address and XP packets; and

a transiting step of transiting the frames destined to other nodes so as to forward the frames destined to other nodes to a next node.

43. A data transmission method according to claim 42, further comprising:

a destination flow determining step of determining a destination flow of the XP packets for a node with a Universally or Locally administered address; and

a flow Tx framing step of converting said XP packets for a node with a Universally or Locally administered address into data of format of local flow and sending the local flow data to a corresponding flow determined in said destination flow determining step.

44. The data transmission method according to claim 41, wherein said transiting step transits the frames destined to other nodes at a fast and almost fixed rate.

45. The data transmission apparatus according to claim 41, wherein said multiple service ring is a dual-ring structure consisting of a pair of unidirectional count-rotating ringlets, said multiple service flow is based on RPR.

46. The data transmission method according to any one of claims 41 to 43, wherein said destination flow determining step includes a discriminating step of determining whether said

received packets for a node with a Universally or Locally administered address are unicast, multicast or broadcast; a flow member copying step of making copies of the packets for each of the corresponding flow if multicast or broadcast is determined within a membership group in a node; and flow identifier determining step of determining destination flow from FT and FN fields in the received frames.

47. The data transmission method according to claim 46, wherein said transmission setup step sets up destination node address(NA), and FT and FN fields for indicating the type and NO. of the destination flow.

48. The data transmission method according to claim 47, further comprising a Tx scheduling step before the TX framing step for scheduling the transmission of data frames according to a priority of the frames, and decide which frame will go first to the downstream along the ringlet.

49. The data transmission method according to claim 48, further comprising a flow based protection (FBP) step for performing flow based protection to provide at least one flow to be used as a standby in case of failure of the used flows.

50. The data transmission method according to claim 49, wherein said FBP step provides 1+1 FBP to designate a mate Standby Flow with the same service property, source and sink in which payloads of the mate Working Flow and Standby Flow carries the same traffic, and once FBP occurred for this working flow, said standby will replace this working flow within 50ms.

51. The data transmission method according to claim 49, wherein said FBP step provides 1:1 FBP to designate a mate Standby Flow with the same service property, source and sink in which payloads of the Standby Flow can run the other additional traffic, and once FBP occurred for this Working Flow, the additional traffic will be dropped out within 50ms.

52. The data transmission method according to claim 49, wherein said FBP step provides 1:N FBP to designate a mate Standby Flow with the same service property, source and sink in which payloads of the Standby Flow runs the other additional traffic, and once FBP in one of N Working Flow occurred, this additional traffic will be dropped out within 50ms.

53. The data transmission method according to any one of claims 49—52, wherein said FBP step is for one of Ethernet and TCE.

54. The data transmission method according to claim 53, wherein said MSF uses Fairness arithmetic and supports both local address and global node address, said local address is PLAS that is an address of node link on the MSF ring and has local meaning only along the MSF ring.

55. The data transmission method according to claim 47, further comprising a frame sequence number generating step of generating frame sequence number sequentially with respect to a specified modulus for each of the data frames to be transmitted at the transmitting side ; and

at the receiving side, a FSN extracting step of extracting a FSN with respect to a peer-to-peer modulus from the received data frames; a counting step at the receiving side of counting the number of the received data frames; and a comparing step of comparing the counted frame number with the extracted FSN, if mismatch, an error reflecting transport performance is indicated.

56. The data transmission method according to claim 55, wherein said destination flow determining step gets at least one of PT, PFI, a value of FT/CS/NM, FN and FSN from the received frames from the upstream node, and said transmission setup step attaches PT, PFI, a value of FT/CS/NM, FN and FSN into the data frames to be transmitted.

57. The data transmission method according to claim 56, wherein said Rx framing step, Tx framing step and the transiting step are of IEEE802.17 MAC layer; said flow Rx framing step, said transmission setup step, and said destination flow determining step, said FSN generating step, FSN extracting step, counting step, comparing step, and flow Tx framing step are of the XP layer.

58. The data transmission method according to claim 57, further comprising a flow adaptation function of the signal and rate transform, synchronous function between two sides of peer, and said flow adaptation function is of a flow processing layer.

59. The data transmission method according to claim 58, wherein said flow processing layer is a upper layer of said XP layer, said XP layer is a upper layer of said IEEE802.17 MAC layer, and corresponding interface functions are provided between the respective layers.

60. The data transmission method according to claim 57, further comprising a shaping step of generating a rate-limiting indication so as to reject excessive transmissions and avoid overflow, and said shaping step is of XP layer.

61. The data transmission method according to any one of claims 41—43, wherein said frame includes at least one of a RPR header field, Extended protocol field, PT field, PFI field, Reserved fields, FT/CS/NM field, FN field, FSN field, HEC field, payload of XP, and XP payload FCS.

62. The data transmission method according to any one of claims 41—43, wherein a network of said MSF is divided into a XP layer network that provides the transport of adapted information through a XP trail between XP access points and a MDL layer network that provides the transport of adapted information through a MDL trail between access points.

63. The data transmission method according to claim 62, further comprising a XP trail termination source step of accepting adapted information when inputting, adding the flow traffic, inserting CS or NM packets and presenting the characteristic information of the XP layer network when outputting, and a XP trail termination sink step of accepting the characteristic information of the XP layer network when inputting, terminating the flow traffic, extracting the CS or NM packets and presenting the adapted information when outputting, wherein said XP trail termination source step and sink step are of XP layer network.

64. The data transmission method according to claim 62, further comprising a MDL trail termination source step of accepting adapted information when inputting, inserting CS or NM packets and presenting the characteristic information of the MDL layer network when outputting, and a MDL trail termination sink step of accepting the characteristic information of the MDL layer network when inputting, removing the CS or NM packets and presenting the adapted information when outputting, wherein said MDL trail termination source step and sink step are of MDL layer network.

65. The data transmission method according to claim 62, wherein said MSF network provides the information transfer capability required to support various types of services of different bit rates by various server layers, and offers a XP trail and uses the XP trail in a server layer network.

66. The data transmission method according to claim 62, further comprising a XP/Client adaptation source step of performing the function of adding XP header between the inputting and outputting, and a XP/Client adaptation sink step of performing the function of remove XP header between the inputting and outputting.

67. The data transmission method according to claim 62, further comprising a MDL/XP adaptation source step of performing the functions of packet multiplexing and adding MDL header between its inputting and its outputting, and a MDL/XP adaptation sink step of performing the functions of packet de-multiplexing according to flow number value and MDL header extraction between its inputting and its outputting.

68. The data transmission method according to claim 62, wherein said MSF network provides a point-to-multipoint MDL Network Connection/Flow that multicasts customer traffic from single node to a group of nodes; and a point-to-multipoint XP Network Connection that multicasts customer traffic within a single node, from an MDL/XP adaptation sink to multiple XP/Server adaptation sinks.

69. The data transmission method according to any one of claims 41-43, wherein said flows include at least one of Ethernet, TDM Circuit Emulation including the emulation of G.707 SDH circuit -- Transport of TU-11, TU-12 or TU-2, G.702 PDH circuit -- Synchronous and asynchronous circuit transport, Video signal, Voiceband signal, Digital channel supported by 64 kbit/s-based ISDN, and an trunk pipe of other MSR span with a lower rate than that of this trunk pipe.

70. The data transmission method according to any one of claims 41-43, further comprising: a flow based multicasting step of duplicating data frames from a source flow getting a payload of the frame to other multiple flows with the same FT field value within a node.

71. The data transmission method according to any one of claims 41-43, further comprising: a bandwidth limiting step of providing bandwidth limitation to a specific flow.

72. The data transmission method according to any one of claims 41-43, further comprising: a merging step of merging plural flows of the same FT field value to form a flow merging group(FMG) similar to one logical link.

73. The data transmission method according to any one of claims 41-43, further comprising: a line speed filtering step of filtering and classifying frames based on certain protocol fields of upper layer in the payload of frame.

74. The data transmission method according to any one of claims 1-3, further comprising: a flow mirroring step of monitoring the incoming or outgoing traffic on a related flow by connecting a sniffer to a "mirrored to" flow.